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Report on the Expedition to Vadsö, in Finmark, to observe the Total Solar Eclipse of 1896 *August* 9. By A. A. Common, LL.D., F.R.S.

In accordance with the arrangements made by the Committee I left England on July 25 in the S.S. *Norse King*, arriving at Vadsö on August 2 with my party.

During totality the sky was cloudy, and no observations were made or photographs taken.

The arrangements were made as follows :—

Observers.—My party consisted of Mr. A. Hinks, of the Observatory, Cambridge ; my son, T. A. Common, Undergraduate, Trinity College, Cambridge ; Major MacMahon, F.R.S. ; Mr. W. H. Wesley, Assistant Secretary R.A.S. ; and my workman, Alfred Wooldridge.

At the request of the Secretary of State for India Mr. K. D. Naegamvala, of the Poona Observatory, India, was attached to the party.

Mr. Naegamvala's object in going to Norway was to gain experience in view of the next Total Solar Eclipse, the central line of totality of which passes near Poona.

Mlle. Klumpké, of the Paris Observatory, also accompanied us.

Instruments.—Two cœlostats with 16-inch plane mirrors were taken, one being the property of the Royal Astronomical Society, the other my own. With these it was proposed to use—

1. The twin telescope as used in Para Caru, Brazil, in 1893. This telescope has an achromatic lens of 3·85 inches aperture and 62 inches focal length, giving an image of the Sun about $\frac{5}{8}$-inch diameter, and also a $4\frac{1}{2}$-inch lens, which in combination with a negative lens of about 8-inch negative focus gives an image about $1\frac{5}{8}$-inch diameter. This combination is arranged to give an image in the same plane as the other. Plate-holders carrying two $6\frac{1}{4} \times 6\frac{1}{4}$ plates fit to the end of the twin tube, and are held in place by a clamp during exposure.

Instead of the ordinary slide, which has to be withdrawn to uncover the plate, a flap is used which opens out into the tube, and may, if needed, be used for making the exposures. The single lens has been used in previous eclipses, and is designated the Abney lens. It is one of a pair forming a photographic lens, formerly belonging to Captain Abney, C.B., now the property of the Royal Astronomical Society. An exactly similar twin telescope was made for and used in the 1893 eclipse at Fundium, West Africa.

2. A 6-inch doublet lens by Grubb, the property of, and kindly lent for this occasion by, Mr. F. McClean, F.R.S. This had a similar negative combination to that of the twin telescope arrangement, but the image in this case was $3\frac{1}{2}$-inch diameter.

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This instrument was mounted on a firm wooden framework, and provided with two plate-holders, each carrying three 12 × 10 inch plates. A long frame was attached to the framework, which carried the plate-holders in such a way that the plates could be successively brought to the place required by merely sliding them along the frame, the exposure being made by a hinged shutter near the concave lens.

3. A slit spectroscope with $3\frac{1}{2}$-inch lenses and two 60° light flint prisms.

4. A grating spectroscope, with which it was intended to get the photograph of the spectrum of the corona without a slit.

With instrument No. 1 it was proposed to make exposures of

No. of Slide.	Exposure in Seconds.	Plates.
1	3	Dry collodion plates
2	9	,,
3	27	,,
4	12	Cadett ordinary plates
5	6	,,
6	3	,,

This arrangement uses 60^s of the 104 available at this station. Mr. Hinks had charge of this instrument, Major MacMahon acting as recorder, and two sailors of H.M.S. *Active* handing and receiving the plate-holders. Mr. Hinks found by experience that an allowance of 7^s for changing one slide for another was sufficient.

With instrument No. 2 it was intended to make exposures of

No. of Plate.	Exposure in Seconds.	Plate.
1	3	Dry collodion
2	6	,,
3	27	,,
4	20	Cadett ordinary
5	10	,,
6	5	,,

I took charge of this instrument, Mr. J. J. Atkinson acting as my recorder.

The slit spectroscope had a double dark slide carrying two whole plates, one being dry collodion, the other Cadett ordinary, two exposures of 35^s being given. A. Wooldridge had charge of this instrument.

With the grating spectroscope, which was provided with a 12 × 10 Cadett ordinary plate, it was prepared to take photographs with the same exposure as with the large lens, these instruments being fed by the same cœlostat. T. A. Common had charge of this instrument.

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The R.A.S. cœlostat was used with the twin telescope and the slit spectroscope.

The instruments had been erected at Ealing, and carefully focussed and marked, the focussing having been done on the Sun through deep blue glass in the case of the instruments Nos. 1 and 2.

As our arrival on August 2 was at midnight nothing could be done till the next morning, when, in the company of Sir R. S. Ball, I visited the Governor (Prebensen) of Finmark. In fixing upon Vadsö as the site I was largely influenced by a very complete report on the weather and other conditions affecting the various possible positions from Vardö in the north to the Tana river in the west, and the various positions on the south side of the Varanger Fiord kindly obtained for me by Mr. Pirrie, the managing director of the Norse King Steamship Company, who made a special trip to Vadsö in the spring.

Governor Prebensen gave the fullest leave to us to choose any site we might think proper. After visiting the observatory of Dr. Copeland, of Edinburgh, who had chosen a site on the hill about 1¼ miles north of Vadsö, and the observatory of M. Hasselberg, some few yards to the west of Dr. Copeland, I chose a site somewhat nearer the town and near the toboggan slide.

After the selection of this site we returned to the ship about noon, and found that the instruments had been landed on the quay. As soon as possible all was carted up to the site, and work at once begun.

A wooden house had been made in England in parts that could be easily put together, and this was erected, and the corrugated iron roof put on, in a few hours. All the instruments were safely housed by eight o'clock.

Active work was begun early on the 4th. An iron wire attached to posts driven into the ground served to define the ground we wished to reserve, and was quite sufficient in the case of the natives; but the small cows that grazed on the moor had not the same respect for our landmark. The instruments were erected on stone foundations, the R.A.S. cœlostat being in the corner of the wooden house, the other in a small shelter made for it.

Open frames of wood were made where the telescopes had to be placed for receiving the light from the cœlostats, and filled with some 1½ tons of large stones. These frames made a most substantial foundation for the instruments, complete steadiness being obtained by piling heavy stones on them when fixed in position. A canvas awning was fixed on poles over each instrument, and was found sufficient protection, but, as stated further on, it would be much better to have the whole under one roof.

Owing to the absence of the Sun and the practical impossibility of seeing a star, considerable difficulty was found in getting the cœlostats into position in azimuth. A rough test we

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obtained of the Sun's image at an interval of some hours showed a slight shift upwards in both cases. With constant sunshine there would have been no difficulty in getting the adjustments sufficiently correct in a short time. Where this cannot be depended upon it is necessary to allow much more time than we had at our disposal.

In the preparatory work I had the help of several fellow passengers. H.M.S. *Active*, of the Training Squadron, was in the harbour of Vadsö, and Commodore Atkinson very kindly placed a boat's crew and boat at my disposal, and also gave me the services of Yeoman Signaller Simmons and signalman three days before the eclipse, and four sailors on the day of eclipse. The boat was a very great help, as we left the ship at an early hour each morning. Rehearsals were made on the Saturday, and all was ready by Saturday night.

A drenching rain in the early morning of the day of the eclipse got us into the proper frame of mind to meet the disappointment we experienced some hours later.

A short time before totality was due blue sky was seen in the north, and the clouds began to roll away from the Sun at such a rate that it seemed as if it would clear, but by the time these clouds had got away others had come up from the west and covered the Sun.

Mlle. Klumpké had a telescope erected in the north part of our enclosure, and purposed taking time observations of the contacts, assisted by M. Fano.

Sir R. S. Ball had an equatorial telescope in the south side, and undertook to give the signal to stand by about three minutes before totality, and the time of second contact. On hearing this J. S. Simmons began counting seconds 104 to 0 by the help of a dead-beat seconds watch. I had arranged that all should be done as if the sky was clear, and at the word the exposures were all duly made without the least hitch. The darkness did not roll away when our counter gave the last second, and one had a strange feeling that something had gone wrong, for the darkness and the silence were very oppressive. In a few seconds the light returned and the total eclipse was over for us.

On comparing notes Sir R. Ball came to the conclusion that he had given the signal too soon, the faintness of the image as seen through the clouds quite accounting for this

On developing the plates on my arrival home we found on the first plate exposed to the Abney lens a thin crescent, evidently the last remaining part of the Sun as seen through thick clouds. A copy of this photograph is sent herewith.

Nearly the whole population of Vadsö—some 1,400—turned out to see the eclipse, a great many coming round us. Major Barlow, R.A., kindly undertook, with the help of a staff of special constables, to keep order if needed, but all behaved in the most charming way.

Mr. Wesley was prepared to make sketches of the corona, but under the circumstances nothing was done. He and others made observations of the appearance of the sky, &c., but nothing of importance was noted.

With the exception of the want of sunshine for adjustment all the arrangements made answered well. The time at our disposal for setting up the instruments was hardly enough, partly owing to the above reason, but the days were very long, and under ordinary circumstances the time would not have been enough.

The instruments all went well. From want of experience in eclipse work I cannot speak with authority on the matter, but I think that there can be no doubt that the cœlostat is the proper instrument for eclipse work. I can easily see the very great additional work we should have had to do if we had been using equatorial mountings. A great improvement might be made by housing the whole of the apparatus under one roof, suitable openings being left for the requisite sky to be seen from the cœlostat.

The arrangement I used with the large lens for sliding the plate-holder along in a frame is very much better than the plan in use with the twin telescope of putting in and taking out each plate-holder separately, a plan necessary in the case of the equatorial mounting for which the twin telescopes were made; but if these are to be used again a sliding arrangement should be used, and I am not sure that it would not be better to still further reduce the hand movement necessary now to expose successive plates by having a mechanical arrangement to do all when once started.

Another point. This eclipse shows that all available stations should be occupied if possible; in this case it would have been well if Bodö had been occupied. On going up the coast I observed the sky in the early morning, and found it very fine indeed, and had it been possible I should have left part of my party at Bodö, Mr. Hinks, in the right scientific spirit, expressing his willingness to forego the pleasures of the longer voyage and to stay there if required. The difficulty of dealing with the instruments separately, however, prevented this being done; nor could I induce any of the many observers on board to stay behind.

Report to the Joint Eclipse Committee on the Expedition to Kiö Island. By Professor J. Norman Lockyer, C.B., F.R.S.

The party consisted of Mr. Fowler, Dr. W. J. S. Lockyer, and myself. As it was impossible for me to leave London before July 22, Mr. Fowler and Dr. W. J. S. Lockyer went on in advance and joined H.M.S. *Volage* at Hammerfest on July 22,